Establishment of Introduced Parasitoids of the Silverleaf Whitefly in Imperial Valley, CA

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An intensive effort was made to establish effective biological control agents on silverleaf whitefly (SLW) in the desert southwest from 1994 to 1999. Exotic species and strains of *Eretmocerus* and *Encarsia* were greenhouse-reared and released in large numbers (exceeding several million for many species) in commercial fields, refuge nursery plots and urban yards by State, Federal and University scientists. This report represents a brief review and update on the establishment of introduced SLW parasitoids in Imperial Valley. Specifically, the update represents a three year survey in commercial cotton fields, a limited set of data collected from two long-term refuge field plots and two home sites in Brawley, CA. Species identification was accomplished using recently published morphological keys and by DNA analysis (RAPD-PCR) conducted by the USDA-APHIS, Plant Protection Center, Mission, TX.

Each year, from 1994 through 1997, exotic parasitoids were released into long-term refuge field plots (1/2 to 1 acre) on multiple occasions each year. Plots were located at the Imperial Valley Research Center near Brawley, and at an organic farm at the south end of Imperial County. During the warm season, the plots consisted of okra and basil. During the cool season, cole crops (esp. collard) and sunflower were present. Kenaf, roselle and eggplant were also periodically present (1994-1996) along with adjacent plantings of cotton and spring planted cantaloupe. Leaf samples were taken approximately 8 times each year from 1994 to 2001 to determine parasitoid population increase and persistence. Our report last year, reviewed the establishment process in detail. Table 1 summarizes the progressive increase in exotic *Eretmocerus* over six consecutive years averaged across all plant species by year, within the refuge field plots. This is based on field collections of *Eretmocerus*, and the determination of the percentage of exotic compared to the native *E. eremicus*. Historically, *Eretmocerus eremicus* has been a very common native SLW parasitoid within the region and is particularly common in mid to late summer, parasitizing SLW on many plant species. During 2001, SLW densities on most plant species in the field plots, with the exception of cantaloupe, were particularly low. In contrast to the previous three-year period, the majority of *Eretmocerus* were native *E. eremicus*, reflecting a one-year decline in exotic *Eretmocerus* spp. activity. Of the two home sites monitored, one had few exotic parasitoid species whereas exotics were dominant at the other.

Surveying conventionally managed cotton fields from 1998 to 2000 provided further evidence regarding the extent of exotic parasitoid establishment. Leaf samples were obtained from three edges of cotton fields each year during September and October. Exotic *Eretmocerus* were detected in 10 of the 23 fields (43%) sampled in the fall of 1998, 31 of 42 fields (74%) sampled in the fall of 1999 and 23 of 24 (96%) sampled in 2000 (Figs. 1a-c). In those fields where exotic *Eretmocerus* were detected, 4% of the *Eretmocerus* were exotics in 1998 and 21% were exotic in 1999 and 48% were exotic in 2000. Similarly, an increase in *Encarsia sophia* was noted from 1998 to 2000. *Encarsia sophia* was detected in only one of 23 cotton fields (4%) in 1998. However, *E. sophia* was detected in 27 of 42 cotton fields (64%) in 1999, and 24 of 32 (75%) fields in 2000. Over a three-year period, exotic *Eretmocerus* spp. and *Encarsia sophia* became widely established throughout Imperial Valley. The survey was discontinued for 2001. However, the second author did conduct an extensive survey of cotton fields in 2001, as part of an area-wide, multi-crop parasitoid impact assessment. Results from that study also indicate that

parasitism by exotic parasitoid spp. was lower then would be expected for 2001 (given the results presented above from the 1998 to 2000 survey).

DNA analysis of specimens identified over the past several years indicates that most exotic *Eretmocerus* in this desert region are *Eretmocerus* sp. nr. *emiratus* (from: Ethiopia). and not *E. emiratus* Zolnerowich & Rose (from: United Arab Emirates). *Eretmocerus mundus* Mercet was collected infrequently in refuge field plots and commercial cotton fields. *Encarsia sophia* (=*Encarsia transvena*) from Multan, Pakistan was commonly collected in 1999 and 2000, however, its level of activity also appeared to be less in 2001.

In summary, up to four exotic species/strains of silverleaf whitefly parasitoids are well established in Imperial Valley. Exotic parasitoid populations appeared lower in 2001 than in the previous three years. This may represent year-to-year variation driven by weather effects, or be viewed as a one year unusual event as part of the long-term process of establishment of introduced species.

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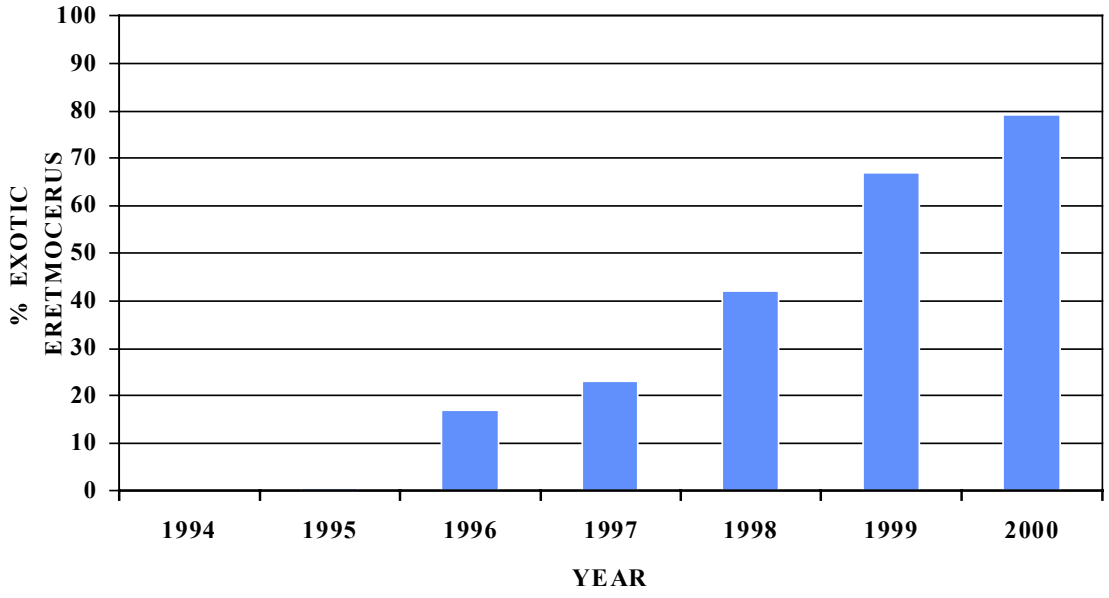
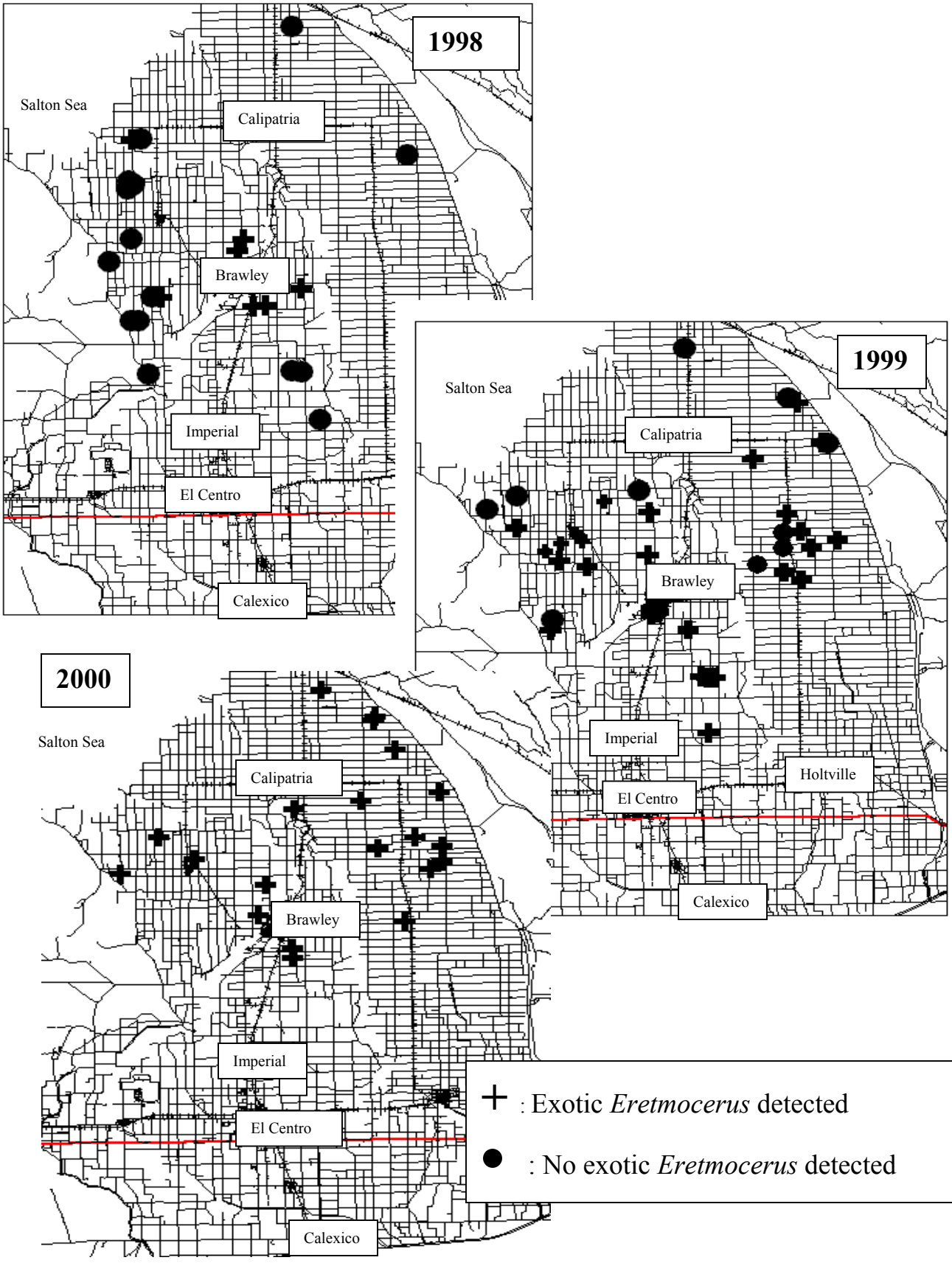
Fig. 1. ESTABLISHMENT OF SILVERLEAF WHITEFLY EXOTIC PARASITOIDS IN THE GENUS *ERETMOCERUS* IN FIELD PLOTS IN IMPERIAL VALLEY, CA
(NO RELEASES IN STUDY PLOTS FOLLOWING 1997)




1998
Salton Sea
Calipatria
Brawley
Imperial
El Centro
Calexico
1999
Salton Sea
Calipatria
Brawley
Imperial
El Centro
Holtville
Calexico
2000
Salton Sea
Calipatria
Brawley
Imperial
El Centro
Calexico
+ : Exotic *Eretmocerus* detected
● : No exotic *Eretmocerus* detected